Bailey

SECTION
E12-77

PRODUCT INSTRUCTIONS

CLASS EA AND EB RECEIVERS (D-C POTENTIOMETER CIRCUIT)

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The Class EA and EB Receivers are used in the Type WM55 Recorder or WM53 Indicator to measure a variable that can be translated into a d-c signal with range spans between 2 millivolts and 300 volts. By means of a d-c potentiometer circuit, the Receiver converts the input voltage to the rotation of a cam, which positions a drive lever that may be used to operate recording, integrating and control devices in the Recorder or Indicator.

CROSS REFERENCES

Instrument or Equipment	Instruction Section
Type KM55 or WM55 Recorder and KM53 or WM53 Indicator	E12-3
Solid-State D-C Amplifier Pt. No. 6618750-□	E12-46
Electric Receiver for Type WM55 Recorder and WM53 Indicator (Assembly and Components)	E12-42

BAILEY METER COMPANY • WICKLIFFE, OHIO 44092

FORM IE12-77-467

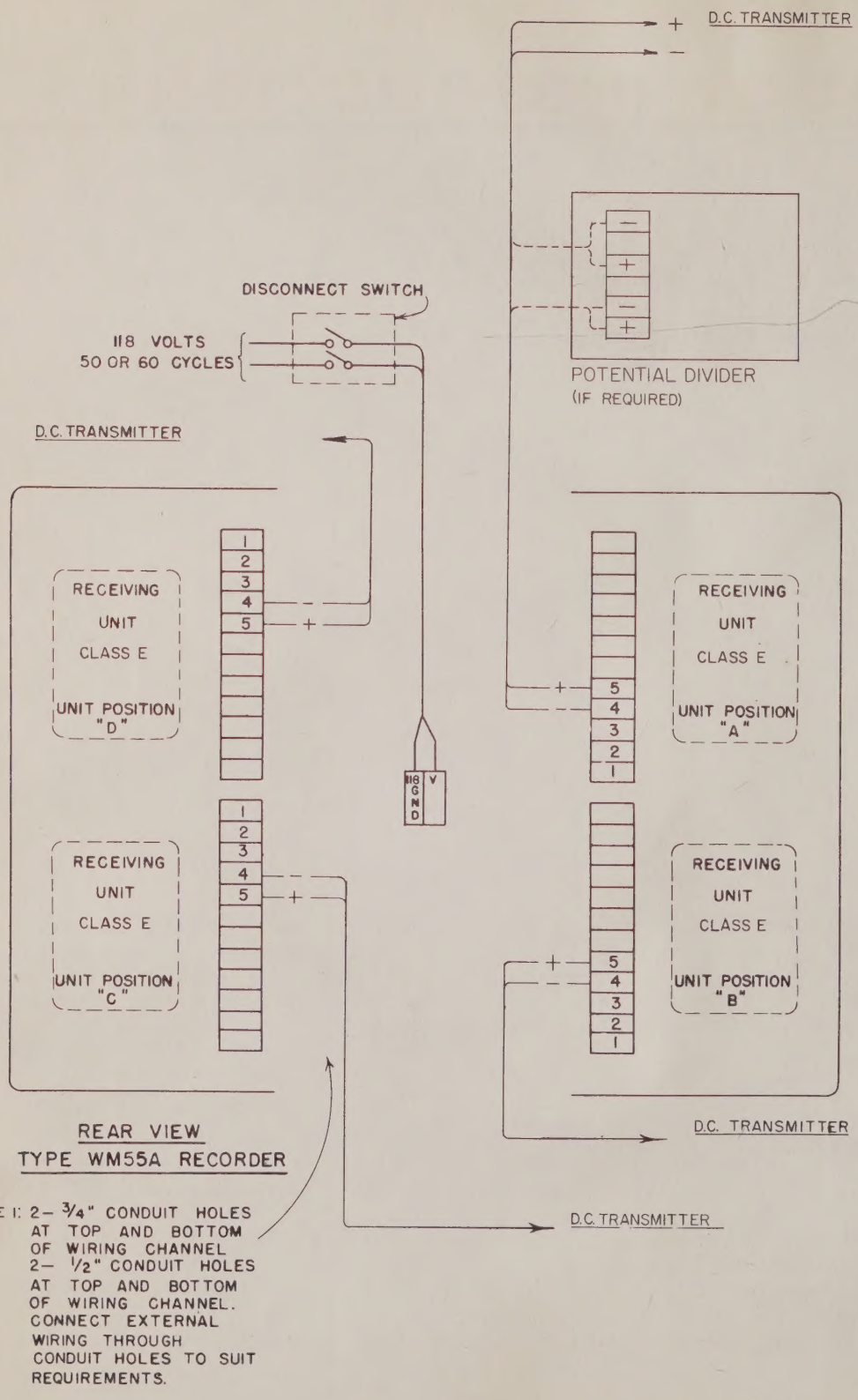


FIGURE 1 - External Connection Diagram

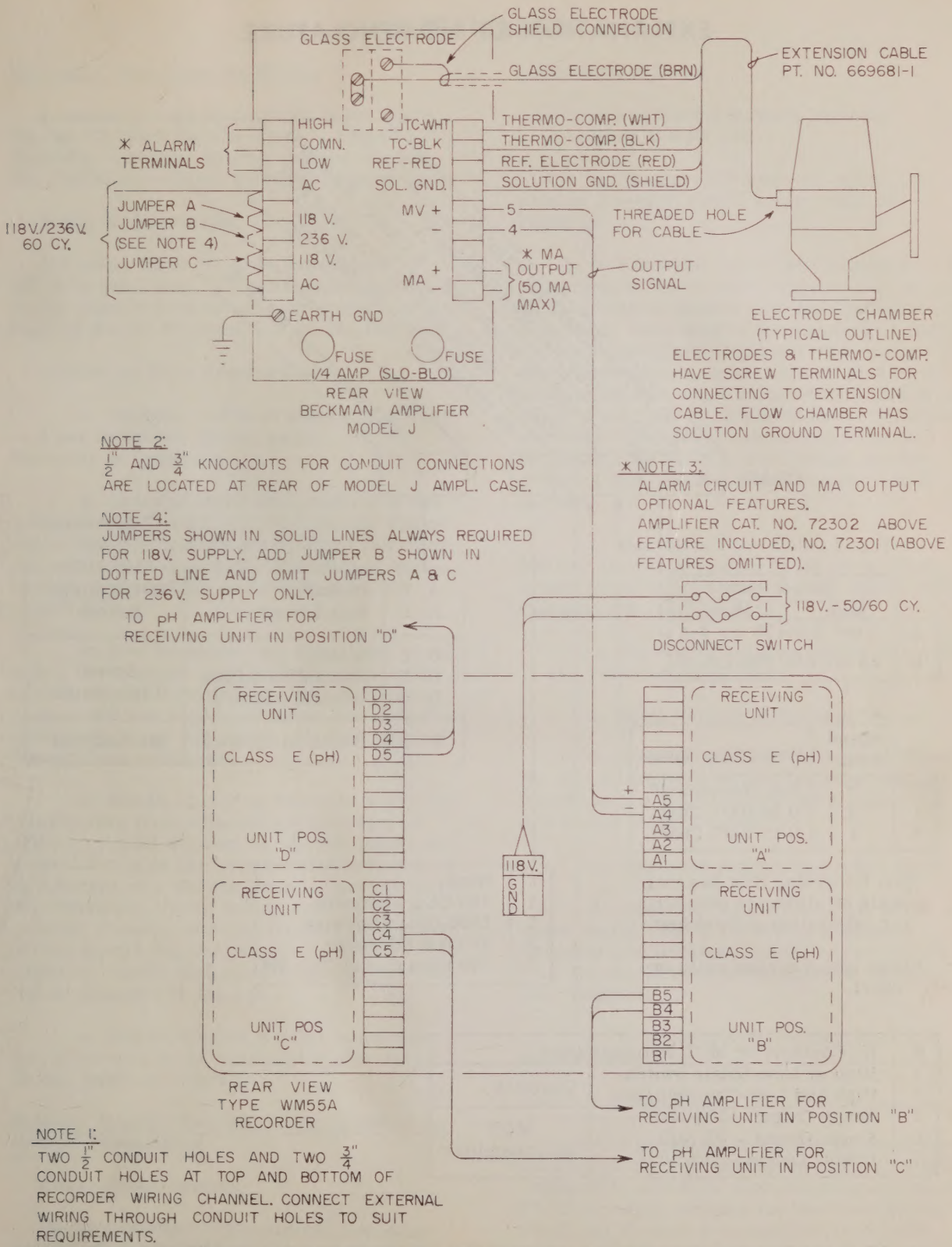
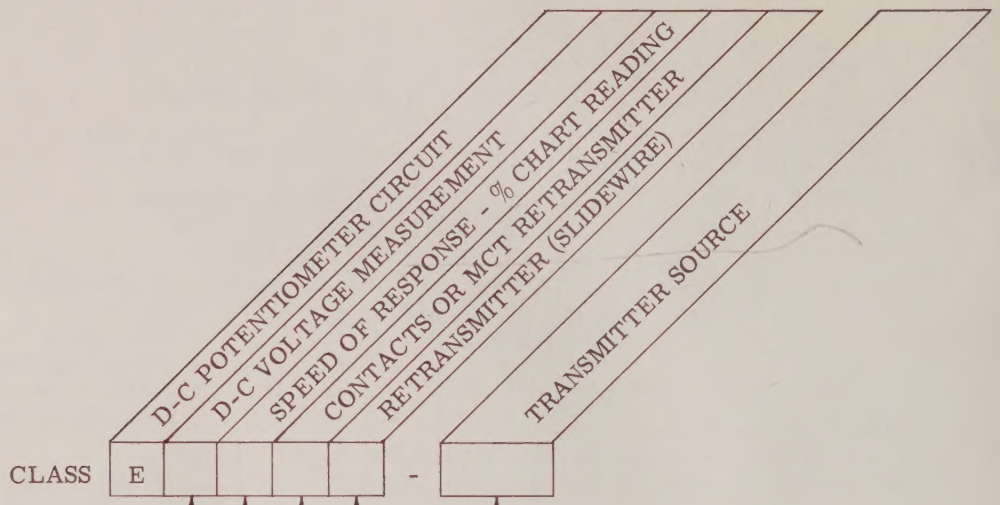


FIGURE 2 - External Connection Diagram for Receiver with pH Transmitter

EXPLANATION OF NOMENCLATURE



	Range Span	
	Min.	Max.
A	2 mv d-c	25 mv d-c
B	25 mv d-c	300 v d-c

	** Speed Sec.	Recording Range
0	5	Non Recording*
1	5	0 to 100% Chart
4	1	0 to 100% Chart

*Non Recording Unit has ring scale on slidewire disc for for calibration and readout.

**Pen speed across scale or chart.

A 1	Linear	D-C Voltage Source
A 2	Non-Linear	
D 1	Weston	Speed Tachometer
D 2	Esternline-Angus	
D 3	General Electric	
E 3	Beckman Model J	pH Analyzer

0	None
1	100 Ohm Slidewire
2	2000 Ohm Slidewire
3	20 Ohm Slidewire
5	500 Ohm Center Tap SW

0	No Contacts or MCT Retransmitter	
1	High or Low-Single Switch	Contacts
2	High and Low-Two Switches	
5	Single Output - 50% Null	MCT Retransmitter
6	Single Output - 0% Null	
7	Double Output - 50% Null	

An "X" in any Nomenclature position indicates that feature is special. An "X" as a suffix to the class indicates that the unit includes some special feature not covered by Nomenclature.

INSTALLATION

External Connections and Wiring

An external connection diagram for Class EA and EB Receivers is shown in Figure 1. Figure 2 shows the external connections for the Class EB Receiver with a pH transmitter.

Power Requirements:

118 volts, 50 or 60 cycle power supply: 107 volts minimum, 127 volts maximum. ±2 cycles maximum variation in frequency. Power load: 13 VA at .90 power factor, per Receiver.

Connecting Wire Requirements:

a. Number of Wires: Measuring circuit -- 2 per Receiver. Power supply -- 2 per Recorder or Indicator.

b. Size and Maximum Length of Wires in Measuring Circuit: No. 22 or larger depending on distance between Recorder or Indicator and measured d-c source. The ratio of lead resistance to leakage resistance must not exceed 0.01.

c. For the measuring circuit use wires with a low leakage, good dielectric insulation. Insulation wall thickness must be suitable for at least 600 volt rated operation. Use asbestos covered wire, or equivalent, for high ambient temperature conditions.

d. Shielding may be required to prevent interference from adjacent power wiring or other electrical devices. If adjacent power or control wiring is carrying current in excess of 25 amperes or a voltage greater than 240 volts, the measuring circuit wiring must be run in metallic shielded cable or conduit. If adjacent wiring is carrying current in excess of 35 amperes, shield must be of magnetic material and be grounded at one end.

e. Any number of similar measuring circuit wires may be combined in one close group, cable, or conduit.

External Connections and Wiring for Receiver with pH Transmitter

Power Requirements:

Bailey Recorder requirements are same as above. Beckman Amplifier requires 115/230 volts ±10 volts at 50/60 cycles, with power load of 23 VA.

Connecting Wiring between Beckman Amplifier and pH Cell:

a. Number of Wires -- 4-wires, including 1-coaxial cable, cable length as required.

b. Extension Cable Specifications -- 4-connecting wires in cable, with overall metallic shield (solution ground) and outer jacket of vinyl insulation, consisting of the following: 1 individually shielded glass electrode lead, with polyethylene insulation, having a minimum in excess of 500,000 megohms per foot (large brown lead). 3 individually insulated leads: reference electrode - red lead; thermo-compensator - two leads, one white and one black; solution ground - blue lead connected to outer shield of cable.

c. Maximum Total Cable Length -- 200 feet for requirements listed here. When a longer length is necessary consult Bailey Meter Company for requirements.

Connecting Wiring between Bailey Recorder and Beckman Amplifier:

a. Same number of wires as above.

b. Size and Maximum Length of Wires: No. 20 or larger. 2500 feet for requirements listed here. If longer length is necessary consult Bailey Meter Company.

c. Insulation required as listed above.

d. Shielding requirements are same as above except, that if the distance between Recorder and Beckman Amplifier exceeds 10 feet, the shield must be grounded at the Beckman Amplifier.

e. Multiple circuit requirements are same as above.

Receiver (Figure 3)

Figure 1 shows Class EA and EB Receivers mounted in the Type WM55 Recorder or WM53 Indicator in any of the four component positions. The unit, which includes the Receiver wiring board, solid-state d-c amplifier, and motor-driven slidewire unit, is secured to the rear of the Recorder or Indicator case by four

mounting screws which are accessible when the amplifier cover is removed.

External electrical connections are made to the measuring and auxiliary terminal blocks adjacent to the Receiver, within the wiring channel on the rear of the Recorder or Indicator.

An adjustable link transmits the motion of the Receiver drive arm to the recording pen or Indicator pointer yoke. The Receiver requires a different link for each Recorder or Indicator case position. Each link is stamped with the letter of the position for which it is suitable. The method for connecting and disconnecting adjustable links is illustrated under "Installation of Additional Components" in Instruction Section E12-3.

If the Receiver is furnished already installed in the Recorder or Indicator:

1. Install Recorder or Indicator as outlined in Instruction Section E12-3 under "Installation" Place pens or pointers in service at this time.

2. Make external electrical connections to Receiver (Figures 1 and 2).

3. Test power source for correct voltage and frequency.

4. Turn on Recorder or Indicator. If Receiver does not operate, see "Operation Checks and Fault Corrections", on page 10.

5. Set amplifier sensitivity adjustment, as described in Instruction Section E12-46.

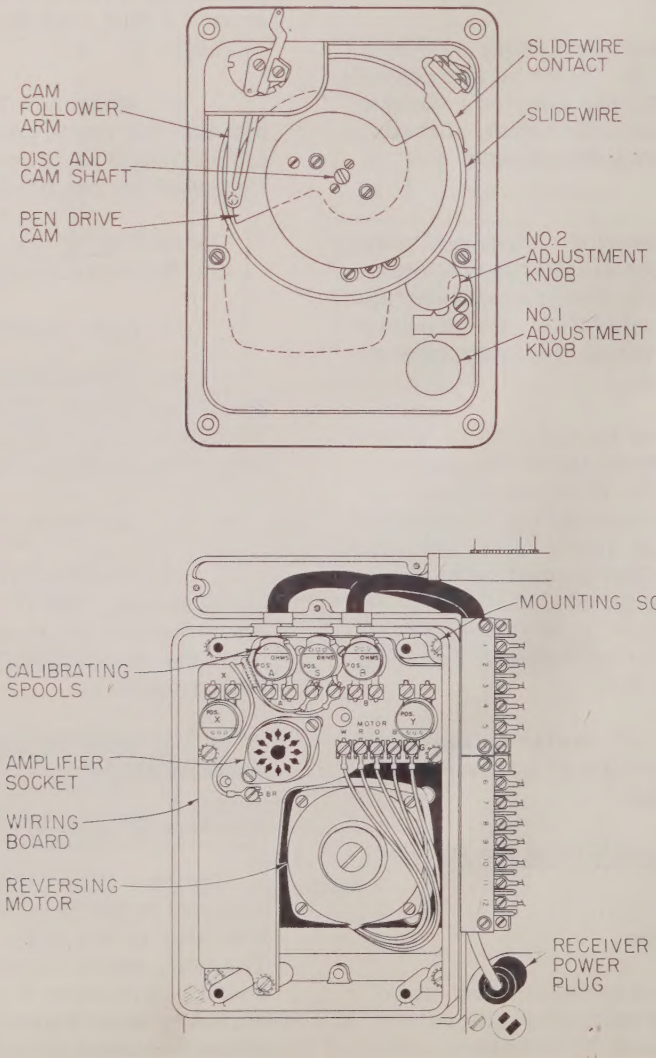


FIGURE 3 - Receiver Assembly

NOTE: The assembly has been factory calibrated and should require no further adjustment or calibration.

If the Receiver is being added to a Type WM5□ Recorder or Indicator, follow the instruction sheet that was shipped with the Receiver kit.

If the Receiver is being changed from one component position to another, use the adjustable link and pen or pointer assembly that are appropriate to the new position. If the pen or pointer assembly for the new component position is not already in service, install the correct pen or pointer assembly and start the pen as described in Instruction Section E12-3 under "Installation of Additional Components". Attach the adjustable link to the Receiver drive arm that is stamped with the appropriate Recorder or Indicator case position letter.

DESCRIPTION

Circuit Description

A simplified schematic diagram of the Class EA and EB circuit is shown in Figure 4. In this d-c potentiometer circuit, Receiver voltage e_2 (proportional to the rotation of the motor-driven measuring slidewire, SW) is balanced against input voltage e_1. Slidewire reference voltage E_r is obtained from a regulated d-c source within the Receiver. Current i_a flows continuously thru the calibration resistances and the slidewire. The position of the slidewire contact determines the value of e_2. Since e_2 balances e_1, slidewire position is proportional to the input voltage, e_1, within the limits of the Receiver's range.

If, in a balanced circuit, e_1 changes and is no longer equal to e_2, then a d-c unbalance voltage, e_b, is applied to the Amplifier. The magnitude of this unbalance is proportional to the change in the measured variable; the polarity depends upon the direction of the change. The motor control section of the Amplifier applies a corrective signal to the reversing motor, M, to rotate the slidewire so that e_2 equals e_1 and the circuit is restored to balance (e_b becomes zero). The operation of the Amplifier is described in Instruction Section E12-46.

In order to obtain suitable filtering of stray a-c signals, the input is connected thru a filter circuit located in the Amplifier (see Figure 5).

A complete schematic wiring diagram of Class EA and EB circuits is shown in Figure 6.

Voltage Divider

Resistor R2 and R3 as shown in Figure 6 comprise a voltage divider which must be used when the Receiver input exceeds 100 millivolts.

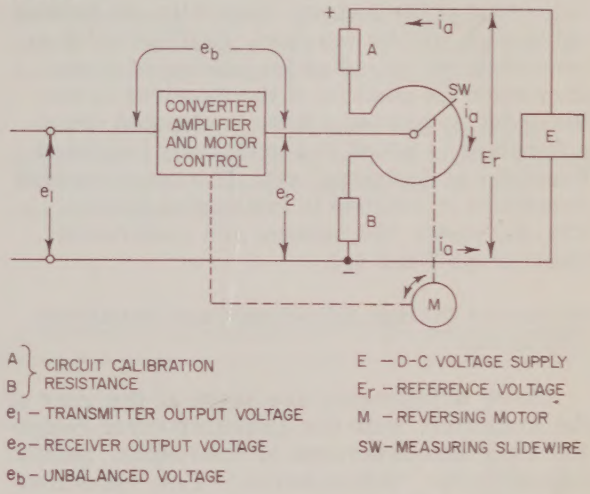


FIGURE 4 - Simplified Class EA and EB Circuit

For input ranges from 110 millivolts to 100 volts, the voltage divider is located on the Recorder or Indicator terminal block. Ranges from 100 volts to 300 volts d-c require the voltage divider to be mounted external to the Recorder or Indicator.

The maximum input to the Class EB Receiver, with a voltage divider, is 50 millivolts.

Contacts and Retransmitters

One or two electrical contacts may be furnished with the Class EA and EB Receiver for alarms, control, etc. In addition, retransmitters (slidewire or movable core transformer type) may be installed in the Receiver. These accessories are described in Instruction Section E12-42.

Signal Failure Protection

Signal failure protection is incorporated in the Amplifier, see Instruction Section E12-46.

ADJUSTMENT AND CALIBRATION

Class EA and EB Receivers are furnished pre-calibrated by the Bailey Meter Company, and require no special calibration when placed into service.

Calibration of Recording Pen or Indicating Pointer

Standard Receivers that are furnished mounted in Type WM5□ Recorders or Indicators had their recording pens or indication pointers calibrated at the factory. Normally, no further calibration will be required. Calibration of a recording pen or indicating pointer is necessary when the position of the Receiver in the Recorder or Indicator Case is changed, when a Receiver is added to a previously furnished Recorder or Indicator, etc. The recommended procedure is outlined in Instruction Section E12-42, under "Adjustment and Calibration". (Omit steps 3 and 4.)

Reference Voltage Adjustment and Sensitivity Adjustment

These adjustments are made at the rear of the Amplifier, with the Amplifier cover removed. They are described in Instruction Section E12-46 under "Adjustments". For maximum accuracy in low range Receivers, allow a 30 minute warm-up period before making adjustments.

Checking Receiver Calibration

To check Receiver calibration, remove the external leads from the Receiver terminal block in the wiring channel on the rear of the Recorder or Indicator, and connect an accurate millivolt potentiometer to the terminals. (The galvanometer in the potentiometer may have to be clamped or short-circuited in order to obtain a steady reading on the Recorder or Indicator.)

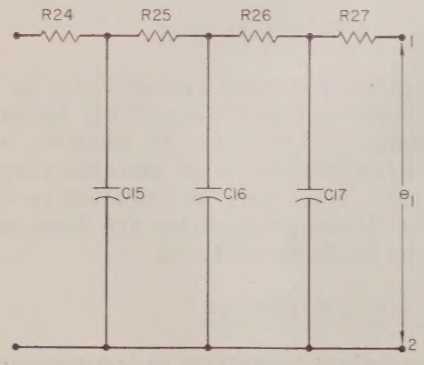


FIGURE 5 - Filter Circuit

pH	Millivolts
14	+34.286
12	+20.00
10	+5.7143
9.2	0.00
7	-15.7143
3	-44.2857
0	-65.714

TABLE A - Calibration Data for Beckman Model J pH Transmitter

1. Apply millivolt inputs to Receiver in accordance with calibration tables that were furnished with Transmitter. A condensed table for pH Transmitter is shown in Table A.

2. If pen or pointer reading is incorrect, adjust reference voltage (see Instruction Section E12-46) to make reading accurate at end points of Receiver's range.

3. Check several other readings within Receiver's range. If Receiver is out of calibration, check for:

a. Defective source.

b. Damaged or bent linkage, loose adjustment etc.

c. Change in resistance of calibration spools or slidewire as a result of shorted turns or mechanical damage.

Receiver with pH Transmitter

Before calibration or standardization of the Beckman Model J pH Analyzer the following checks should be made:

1. Make certain flow chamber is thoroughly desiccated, reference electrode has been filled with potassium chloride solution and a sample is flowing thru flow chamber.

2. Check that function switch on Beckman Analyzer is on standby and Bailey Recorder or Indicator is turned on.

3. With no power on Beckman Amplifier, Analyzer indicator should read 9.2 pH. If

necessary use mechanical zero adjustment beneath indicator scale.

4. After power has been applied to Beckman Amplifier for approximately one minute, indicator should read about 7 pH. Turning standardizing adjustment to its extremes should cause indicator deflect approximately to 5 pH and 9 pH.

5. Repeat step 4 observing Bailey Recorder or Indicator. Class E Receiver must track Beckman indicator readings.

6. If Receiver does not track Beckman indicator readings, perform following checks.

a. Check that small wire wound resistor included with Beckman Amplifier has been installed in accordance with Section 4.2.3 of Beckman Instructions.

b. If resistor is in circuit, disconnect leads at Bailey Recorder or Indicator terminals and short terminals 4 and 5 of Receiver. Recorder or Indicator should now read 9.2 pH on chart or scale. If Receiver fails to respond, check it in accordance with "Maintenance".

c. If Recorder or Indicator responds, remove short and connect a millivolt potentiometer to Recorder or Indicator terminal block. For readings from 9.2 pH to 14 pH, plus lead of potentiometer is connected to terminal 4 and minus lead to terminal 5. From 0 pH to 9.2 pH, reverse leads. Check Receiver calibration as above. If millivolt range is incorrect a resistance spool may have to be replaced.

7. If Recorder or Indicator and Beckman Amplifier are functioning with switch in standby, fault is either in connecting wiring or flow chamber assembly.

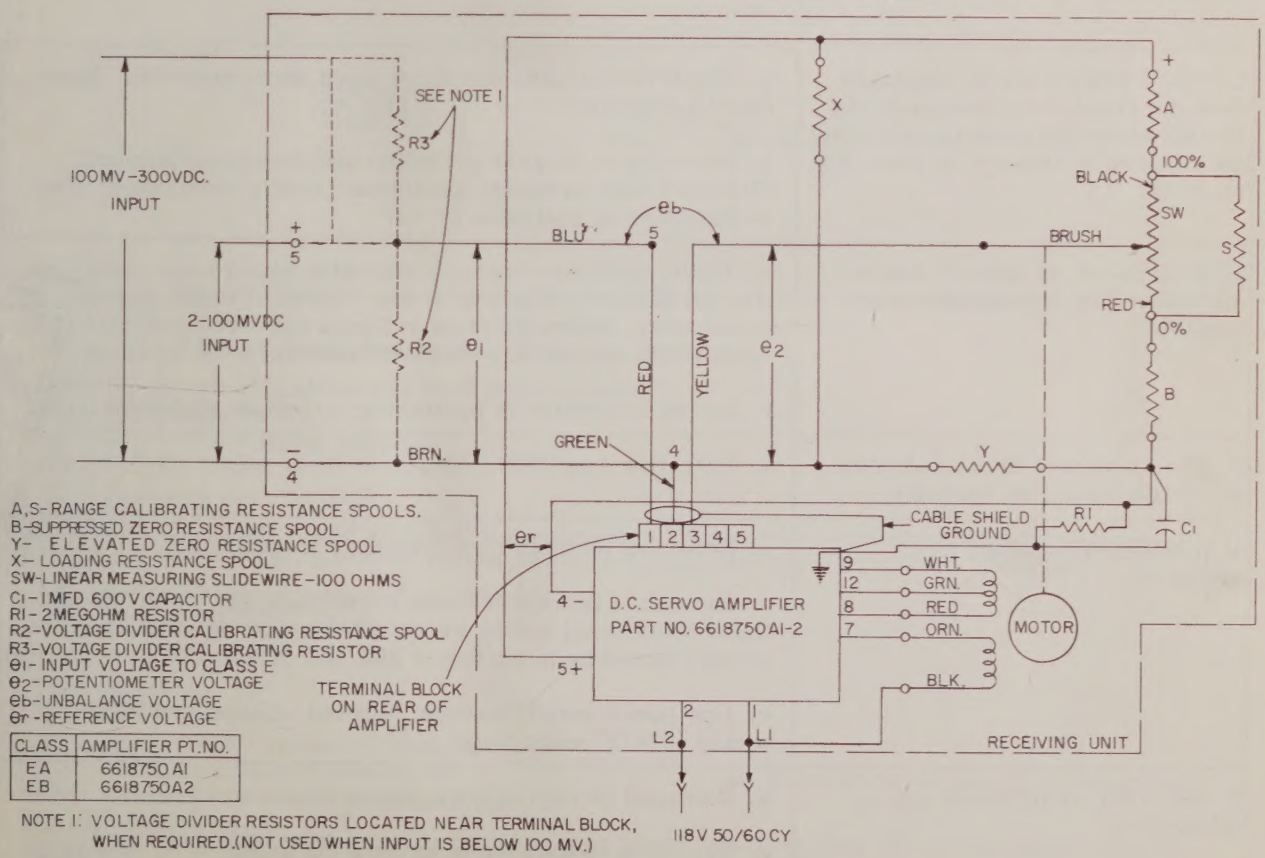


FIGURE 6 - Schematic Wiring Diagram of Class EA and EB Circuit

MAINTENANCE

Information pertaining to the measuring circuit is given below. Maintenance instructions for the Recorder or Indicator, Amplifier, and Electrical Receivers in general, may be found in the Instruction Sections listed under "Cross References" on page 1.

Operation Checks and Fault Corrections

If the Receiver fails to operate or operates incorrectly when first installed, carefully recheck the installation procedure and perform the following checks in the sequence given:

1. Check power supply to the Recorder or Indicator:

Remove wiring channel cover from rear of Recorder or Indicator, and use an a-c voltmeter to check voltage across Recorder or Indicator power supply terminals in center of wiring channel.

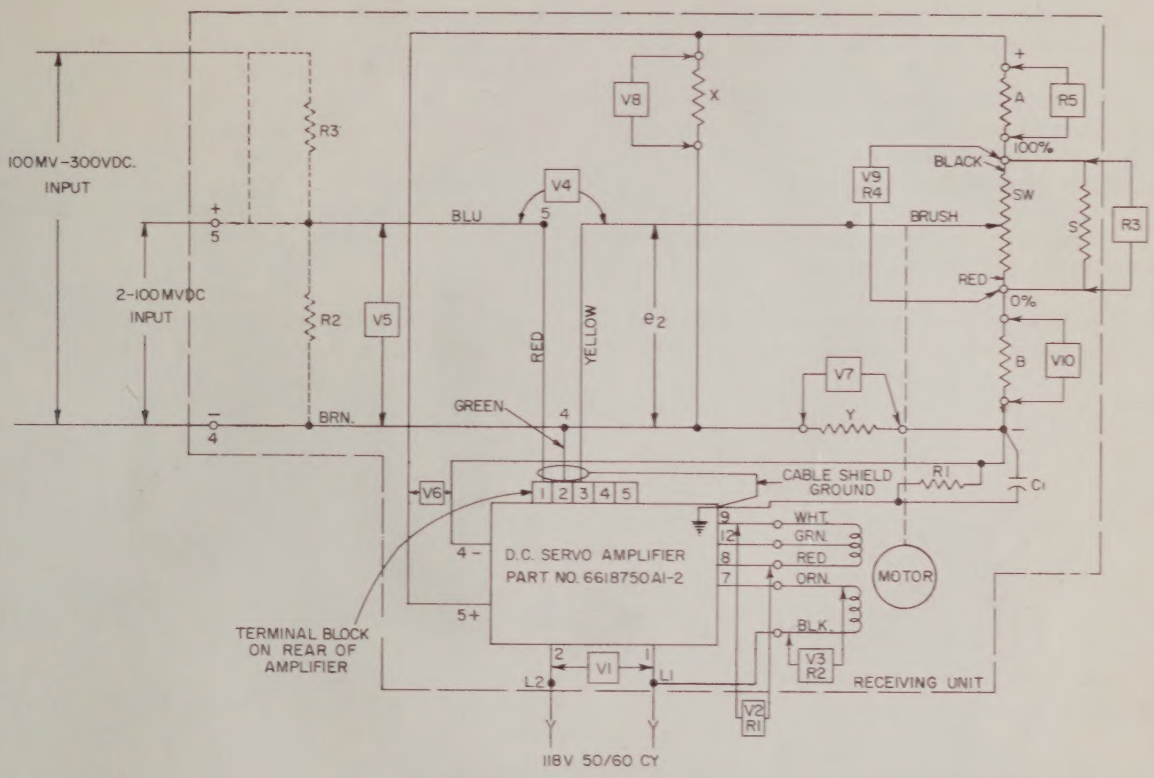
2. Check external connections:

3. If operation is erratic or if motor oscillates rapidly about balance point, fault may be either excessive sensitivity or faulty connections in the external wiring at Recorder or Indicator terminals.

If visual inspection and the above checks, fail to reveal the source of trouble, or if the operation becomes faulty after the Receiver has been in service, refer to Figure 7, and the fault correction chart below.

FAULT CORRECTION CHART FOR CLASS E RECEIVER AND D-C POTENTIOMETER CIRCUIT

1. Pen draws circle on chart and does not respond to changes in the measured variable, or pointer does not respond to changes in measured variable.	a. Amplifier failure. Amplifier input short circuited. Blown fuse in Amplifier. b. Motor rotor or gear reduction unit frozen or jammed. Slidewire disc assembly should turn freely when power supply to Recorder or Indicator is "off".
2. Erratic pen or pointer motion (not caused by rapidly changing variable).	a. Faulty slidewire contact. Slidewire brush must make positive contact over entire slidewire travel. Excess tension will cause wear. Slidewire must be clean and free from all foreign matter. Do not use any abrasive material when cleaning. b. Loose connection in measuring circuit or slidewire leads.
3. Pen or pointer drifts and does not follow measured variable.	a. Defective Amplifier. Amplifier input open.
4. Insensitive or sluggish operation.	a. Defective Amplifier or Amplifier transistors. b. Excessive leakage between conductors and power circuits. Refer to external wiring recommendations. Resistance to ground should be in excess of 250,000 ohms. c. Low power supply voltage. Normal voltage should be within 107-127 volts a-c.
5. Recorder or Indicator not in calibration.	a. Damaged or bent linkage, loose adjustment etc. b. Change in resistance of calibration spools or slidewire as a result of shorted turns or mechanical damage. c. Range increase - open parallel resistor across slidewire.



A-C Voltage Measurements Made on Scale Having 1000Ω /Volt Resistance or Greater

V1 - 118V ±10V
V2 - .5 to 5 V A-C (At Balance) 10 to 20 V A-C Running

Voltage Measurements Made with D-C Potentiometer

V4 - 0 (At Balance)
V5 - 0 to 100 MV (Input Voltage)
V6 - 1.019V D-C
V7 - Elevated Zero Voltage

Voltage Measurements Made with D-C Potentiometer - Since Circuit Designed for 1 MA Current Flow each Branch Potential Drop Across Resistor Equals Resistance Value in Millivolts

V8 , V10 - Value as Indicated on Resistors
V9 - Equals Millivolt Range

Resistance Values

R1 - 23 Ohms
R2 - 850 Ohms
R3 - Range Spool - Remove from Recorder
R4 - 100 Ohms when Disconnected
R5 - Range Spool - Remove from Recorder

} Use Wheatstone Bridge for Measurement

NOTE: Voltage Measurement Checks Should be Made with Amplifier Removed and Connected to Recorder or Indicator by means of Connecting Cable.

FIGURE 7 - Circuit Resistance and Voltage Measurements

REPLACEMENT PARTS

Figure 8 is a parts drawing that applies specifically to Class EA and EB Receivers. Refer to Instruction Section E12-42 for a drawing showing parts that are common to Electrical Receivers of all circuit classes.

Although Parts Drawing E12-106 normally will apply to the Receivers furnished, there may be individual differences in particular Receiver assemblies because of:

a. Design changes made since the printing of this Instruction Section.

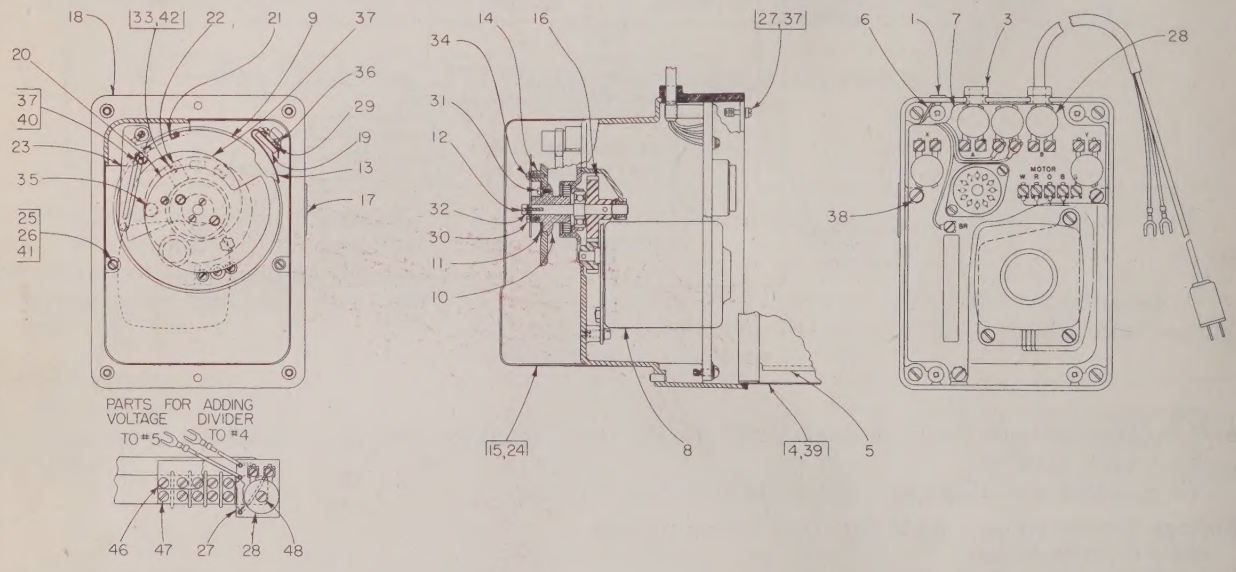
b. Special design of the Receiver furnished to make it suitable for a non-standard application.

Therefore, when ordering parts, assure the receipt of correct replacements for the equipment by specifying on the order:

1. Complete Class identification and code number of the Receiver for which the parts are desired. The code number is shown on a label which is Item 1 of Figure 8.

2. The Parts Drawing on which each part is illustrated. (The Parts Drawing number is given in the title for the Figure.)

Parts Drawings for Recorders or Indicators, are shown in Instruction Section E12-3. For Amplifier parts, see Instruction Section E12-46.



ITEM	PART NO.	NAME
1	CODE LABEL SPECIFY NUMBER WHEN ORDERING PARTS	
2	666364-1	SPOOL, 5 REQD
3	35396-1	GROMMET
4	667206-1	AMPLIFIER COVER ASSY
5	6618750-1	AMPLIFIER ASSY (CL. EA100)
	6618750-2	AMPLIFIER ASSY (CL. EB100)
6	6612342-1	INSULATING PLATE
7	6618802-1	WIRING ASSEMBLY
8	6618667-1	MOTOR ASSEMBLY
9	661805-35	DISC ASSEMBLY
10	666326-1	DISC HUB
11	661501-1	DISC CLAMP
12	663016-1	SPRING KEY
13	667347-1	BRUSH ASSEMBLY
14	662153-1	DOWEL SLEEVE
15	666340-1	SLIDEWIRE COVER
16	666320-1	SHAFT GEAR & BRG ASSY
17	1961013-1	IDENTIFICATION PLATE, 2 REQD
18	666431-1	MOUNTING BRKT ASSY

ITEM	PART NO.	NAME
19	666321-1	BRUSH SUPPORT
20	669571-1	PRE-CUT CAM
21	661483-1	CAM ARM SPRING
22	68839-2	CAPILLARY CLIP
23	668059-1	CAM FOLLOWER SHAFT & DRIVE ARM ASSEMBLY
24	199287-1	LUBSAC & TUBE ASSY
25	6614001-1	COVER SCREW, 2 REQD
26	6614002-1	COVER SUPPORT STUD, 2 REQD
27	6618837-□	VOLTAGE DIVIDER ASSY
28	666364-1	SPOOL
29	3-48x3/16	PAN HEAD SCREW, 2 REQD
30	3-48x1/4	PAN HEAD SCREW, 2 REQD
31	3-48x1/4	FILLISTER HEAD SCREW, 2 REQD
32	3-48x3/16	HEADLESS CUP POINT SET SCR
33	4-40x3/16	PAN HEAD SCREW
34	4-40x5/16	RD HD THREAD CUTTING SCR
35	6-32x1/4	PAN HEAD EXT SEMS, 3 REQD
36	6-32x5/16	PAN HEAD EXT SEMS, 2 REQD
37	8-32x 1/2	PAN HEAD SCREW, 3 REQD

ITEM	PART NO.	NAME
38	8-32x1/2	PAN HEAD EXT SEMS, 3 REQD
39	1/4-20x7/16	PAN HEAD EXT SEMS
40	#8 SAE	LOCKWASHER, 3 REQD
41	#10 SAE	LOCKWASHER, 2 REQD
42	1204-00	SHAKEPROOF LOCKWASHER
43	6-32x3/4	RD HD THD CUTTING SCR, 2 REQD
44	6-32x1/2	RD HD THD CUTTING SCR, 2 REQD
45	6-32x1"	PAN HD THD CUTTING SCREW

SPARE PARTS KIT	
SPARE PARTS KIT PART NUMBER 250018-1	
QTY	PART NO.
2	194776-11001
1	6618667-1
1	667347-1

FIGURE 8 - Parts Drawing E12-106, Class EA and EB Receivers